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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/056,720	01/24/2002	Tomoki Kobayashi	IIW-016	2117

959 7590 11/18/2005

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EXAMINER	
TSANG FOSTER, SUSY N	

ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 11/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	**Application No.** 10/056,720	**Applicant(s)** KOBAYASHI ET AL.	
	Examiner Susy N. Tsang-Foster	**Art Unit** 1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _25 August 2005_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-12 and 14-25_ is/are pending in the application.

4a) Of the above claim(s) _22 and 23_ is/are withdrawn from consideration.

5)☒ Claim(s) _20 and 21_ is/are allowed.

6)☒ Claim(s) _1-12,14-19,24 and 25_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Newly submitted claims 22 and 23 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

Inventions of newly added claims 21 and 22 and of the previously examined claims are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the combination does not recite any of the following: the pressure of about 25 MPa in the apparatus of claim 1, the branched pipe connecting the high-pressure tank to the hydrogen-occlusion alloy tank and the fuel cell in the apparatus of claim 20, the three-way valve in the apparatus of claim 21, a high pressure tank formed of a fiber reinforced plastic for storing hydrogen gas in the apparatus of claim 24, or a hydrogen-occlusion alloy tank formed of an aluminum alloy and having a hydrogen-occlusion alloy accommodated therein, wherein the aluminum alloy of the hydrogen-occlusion alloy tank has a higher heat conductivity than the high-pressure tank in the apparatus of claim 25. The subcombination has separate utility such as a backup electricity generator in a stationary power plant.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 22 and 23 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Response to Amendment

2. This Office Action is responsive to the amendment 8/25/2005. Claims 1, 9, and 12 have been amended. Claims 20-25 have been added. Previous art rejections based on W00/58529 (equivalent document to Okada et al. (US Patent No. 6,835,490 B1)) under 35 USC 102 are withdrawn in view of applicant's arguments on page 11 of the present response. Claims 1-12, and 14-25 are pending. Claims 22 and 23 are withdrawn from further consideration as being drawn to a non-elected invention. Claims 1-12, 14-19, 24, and 25 are rejected. Claims 20 and 21 are allowed. This Office Action is made non-final as new grounds of rejection are made that are not necessitated by applicant's amendment.

Claim Objections

3. Claim 11 is objected to because of the following informalities:

In claim 11, steps (D), (E), and (F) should be written as steps (C), (D), and (E) since step (C) is not recited in claim 9.

Appropriate correction is required.

Claim Rejections - 35 USC § 101

4. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

5. Claims 12, and 14-19 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 12, and 14-19 drawn to a mechanism for warming up a fuel cell do not appear to fall under any of the 5 categories of statutory subject matter. It is noted that the body of claims 12, and 14-19 do not contain method steps such that claims 12, and 14-19 are not process claims. The 5 categories of statutory subject matter are:

1) Process of using product;

2) Product of manufacture;

3) Process of making a product;

4) Apparatus; and

5) Composition (Materials).

Claim Rejections - 35 USC § 112

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. Claims 9 and 10 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant

art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claim 9, the limitation "at least about 25 MPa" is not in the original disclosure. Claims 10 and 11 depending from claim 9 are also rejected for the same.

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 12, and 14-19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 12, and 14-19 drawn to a mechanism for warming up a fuel cell are indefinite because it is unclear what applicant is intending to claim as his invention since the claims do not appear to fall under any of the 5 categories of statutory subject matter. It is unclear to the Examiner what the mechanism is. Is the mechanism an apparatus or a process of using? If the mechanism is an apparatus, it is unclear what makes up the apparatus. For the purposes of prosecution, claims 12, and 14-19 are interpreted as a warming up apparatus for a fuel cell.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 1, 4, and 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO00/58529 (equivalent document to Okada et al. (US 6,835,490 B1) relied upon for translation) in view of applicant's English Translation for JP 60-68 A submitted on 4/29/2004.

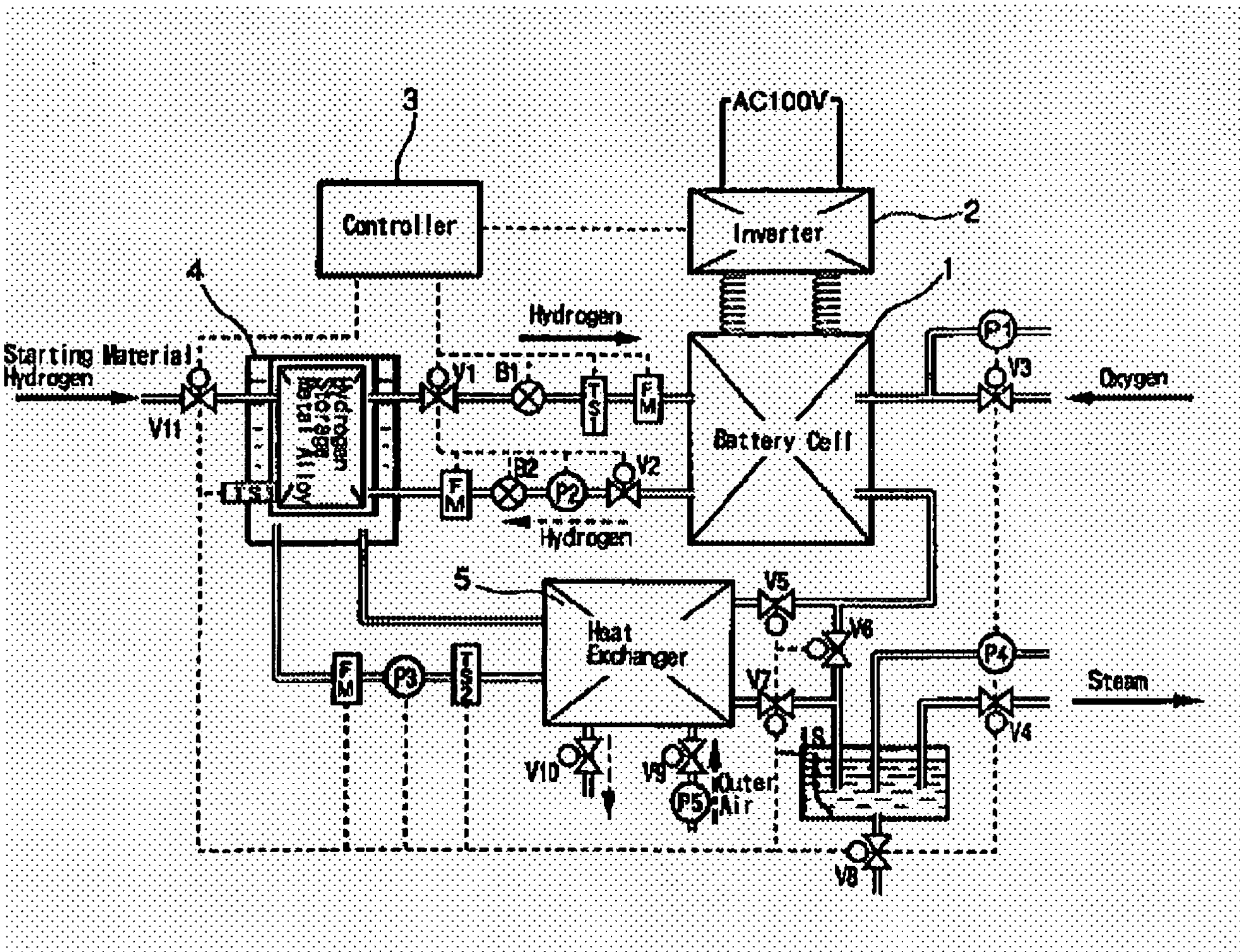
Okada et al. disclose a fuel cell apparatus (see Figure 21 reproduced below) comprising a fuel cell 1, a hydrogen metal hydride storage tank 4 that is capable of supplying the hydrogen occluded in the hydrogen storage metal alloy to the fuel cell, and a heat exchanger 5 that is carried out between the outer air as well as the discharged heat existing in a steam of relatively high temperature discharged from the fuel cell and the cold/warm water as a cooling medium circulated in a cooling/warming medium jacket installed at the <u>outer circumference</u> of the hydrogen metal hydride storage tank 4 (col. 17, lines 12-46). The controller 3 conducts various controls for elevating or lowering the temperature of the hydrogen storage metal alloy in the tank 4, mass control for pressure, flow rate, temperature, etc. with regard to the hydrogen supplied to the fuel cell (col. 17, lines 46-52).

The controller is capable of appropriately controlling a pressure, temperature, and flow rate of the hydrogen gas supplied from the hydrogen metal hydride storage tank to the fuel cell and the pressure, temperature and flow rate of hydrogen gas can be controlled whereby it is possible to control amounts of generated electric energy in the fuel cell depending appropriately

upon the load and to enhance the utilizing efficiency of the hydrogen used in the fuel cell (col. 8, lines 22-33 and col. 18, lines 23-38).

The hydrogen which is to be absorbed with the hydrogen storage metal alloy is supplied as a starting material hydrogen into the tank 4 by connecting a high-pressure hydrogen cylinder to a hydrogen supplying outlet followed by opening the valve V1 whereupon the hydrogen storage metal alloy absorbs the hydrogen from the low-pressure plateau region to the high-pressure plateau region (col. 17, line 65 to col. 18, line 7 and col. 19, lines 8-32).

Simultaneously, the controller releases valves V9 and V10 and also makes pump P5 in an operating state whereby the outer air is sent to the heat exchanger to cool the above-mentioned cold/warm water with the outer air and at the same time, the hydrogen storage metal alloy is monitored with a temperature sensor and the circulation pump P3 is appropriately operated so as to bring the temperature (T1) of the hydrogen storage metal alloy to 40 degree Celsius or lower whereby the above heat-exchanged cold/warm water is appropriately passed into the above-mentioned cooling/warming medium jacket to carry out the cooling of the hydrogen storage metal alloy (col. 18, lines 7-23).



Okada et al. do not disclose heat-transmitting means which transmits heat generated in the hydrogen-occlusion alloy during the course of storing the hydrogen gas from the high pressure hydrogen gas tank in order to warm up the fuel cell, and that the pressure of the hydrogen gas discharged from the high pressure tank is about 25 MPa.

The JP 60-68 A reference discloses a fuel cell apparatus comprising a fuel cell 15, a metal hydride 13 having a high hydrogen equilibrium dissociation pressure placed in tank 4 and a metal hydride 14 having a low hydrogen equilibrium dissociation pressure in tank 10 and the two tanks are coupled to each other through hydrogen transfer valves 11 and 12 (see also Figure

2). A heat exchanger 18 is contained in tank 10 and is coupled with a heat exchanger 16 which heats and cools the fuel cell 15 (see page 5 of applicant's translation). Page 5 of the translation also states that a "solvent for exchanging heat is transferred by means of a pump to circulate solvent so that heat can be smoothly transferred." Page 6 of the translation states "the heat is generated in the metallic hydride MH1 when hydrogen is occluded in the metallic hydride MH1. This heat can also be utilized to increase the temperature of the fuel cell so that the fuel cell can be started again at the time when the fuel cell is stopped."

It would have been obvious to one of ordinary skill in the art at the time the invention was made have a heat exchange arrangement between the hydrogen storage alloy tank and fuel cell of Okada et al. in the form of a heat exchanger on the hydrogen storage alloy tank coupled with a heat exchanger which heats and cools the fuel cell by means of a pump to circulate a solvent so that heat can be smoothly transferred to the fuel cell as taught by JP 60-68 in order to efficiently utilize the waste heat released from the hydrogen storage alloy during occluding of hydrogen from the high pressure gas tank in order to start up a fuel cell.

The Examiner takes Official Notice that high-pressure hydrogen cylinder tanks are commercially available in a variety of sizes and pressures in the hydrogen supply art.

It would have been obvious to one of ordinary skill in the art at the time the invention was made use a high pressure tank of hydrogen gas having a discharge pressure of about 25 MPa in order to rapidly occlude the hydrogen in the hydrogen storage alloy tank which as known by one of ordinary skill in the art has a much lower hydrogen equilibrium pressure.

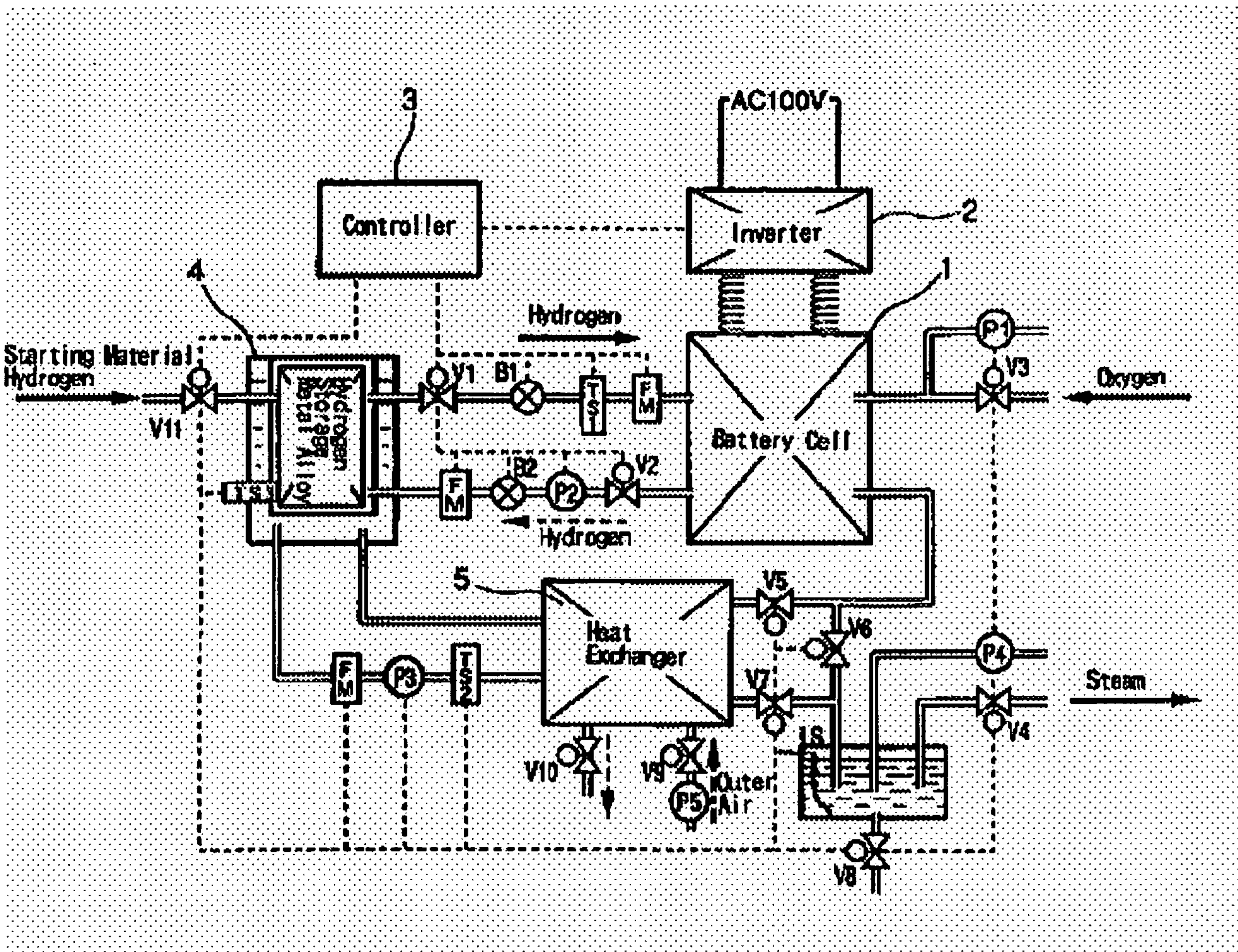
12. Claims 12, 14, 15, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO00/58529 (equivalent document to Okada et al. (US 6,835,490 B1) relied upon for translation) in view of applicant's English Translation for JP 60-68 A submitted on 4/29/2004, Kralick (US 6,350,535 B1) and Aldhart et al. (US Patent No. 4,826,741).

Okada et al. disclose a fuel cell apparatus (see Figure 21 reproduced below) comprising a fuel cell 1, a hydrogen metal hydride storage tank 4 that is capable of supplying the hydrogen occluded in the hydrogen storage metal alloy to the fuel cell, and a heat exchanger 5 that is carried out between the outer air as well as the discharged heat existing in a steam of relatively high temperature discharged from the fuel cell and the cold/warm water as a cooling medium circulated in a cooling/warming medium jacket installed at the outer circumference of the hydrogen metal hydride storage tank 4 (col. 17, lines 12-46). The controller 3 conducts various controls for elevating or lowering the temperature of the hydrogen storage metal alloy in the tank 4, mass control for pressure, flow rate, temperature, etc. with regard to the hydrogen supplied to the fuel cell (col. 17, lines 46-52).

The controller is capable of appropriately controlling a pressure, temperature, and flow rate of the hydrogen gas supplied from the hydrogen metal hydride storage tank to the fuel cell and the pressure, temperature and flow rate of hydrogen gas can be controlled whereby it is possible to control amounts of generated electric energy in the fuel cell depending appropriately upon the load and to enhance the utilizing efficiency of the hydrogen used in the fuel cell (col. 8, lines 22-33 and col. 18, lines 23-38).

The hydrogen which is to be absorbed with the hydrogen storage metal alloy is supplied as a starting material hydrogen into the tank 4 by connecting a high-pressure hydrogen cylinder to a hydrogen supplying outlet followed by opening the valve V1 whereupon the hydrogen storage metal alloy absorbs the hydrogen from the low-pressure plateau region to the high-pressure plateau region (col. 17, line 65 to col. 18, line 7 and col. 19, lines 8-32).

Simultaneously, the controller releases valves V9 and V10 and also makes pump P5 in an operating state whereby the outer air is sent to the heat exchanger to cool the above-mentioned cold/warm water with the outer air and at the same time, the hydrogen storage metal alloy is monitored with a temperature sensor and the circulation pump P3 is appropriately operated so as to bring the temperature (T1) of the hydrogen storage metal alloy to 40 degree Celsius or lower whereby the above heat-exchanged cold/warm water is appropriately passed into the above-mentioned cooling/warming medium jacket to carry out the cooling of the hydrogen storage metal alloy (col. 18, lines 7-23).



Okada et al. do not disclose heat-transmitting means which transmits heat generated in the hydrogen-occlusion alloy during the course of storing the hydrogen gas from the high pressure hydrogen gas tank in order to warm up the fuel cell, that the solvent for exchanging heat between the alloy tank and the fuel cell is water, and that the fuel cell generates power while warming up the fuel cell when the temperature of the fuel cell is within a given temperature range whose upper limit is the prescribed temperature and the warming up is performed with no power generation when the temperature of the fuel cell is under the lower limit of the given temperature range, and that the heat exchanger is located outside of a tank containing the hydrogen-occlusion alloy.

The JP 60-68 A reference discloses a fuel cell apparatus comprising a fuel cell 15, a metal hydride 13 having a high hydrogen equilibrium dissociation pressure placed in tank 4 and a metal hydride 14 having a low hydrogen equilibrium dissociation pressure in tank 10 and the two tanks are coupled to each other through hydrogen transfer valves 11 and 12 (see also Figure 2). A heat exchanger 18 is contained in tank 10 and is coupled with a heat exchanger 16 which heats and cools the fuel cell 15 (see page 5 of applicant's translation). Page 5 of the translation also states that a "solvent for exchanging heat is transferred by means of a pump to circulate solvent so that heat can be smoothly transferred." Page 6 of the translation states "the heat is generated in the metallic hydride MH1 when hydrogen is occluded in the metallic hydride MH1. This heat can also be utilized to increase the temperature of the fuel cell so that the fuel cell can be started again at the time when the fuel cell is stopped."

It would have been obvious to one of ordinary skill in the art at the time the invention was made have a heat exchange arrangement between the hydrogen storage alloy tank and fuel cell of Okada et al. in the form of a heat exchanger on the hydrogen storage alloy tank coupled with a heat exchanger which heats and cools the fuel cell by means of a pump to circulate a solvent so that heat can be smoothly transferred to the fuel cell as taught by JP 60-68 in order to efficiently utilize the waste heat released from the hydrogen storage alloy during occluding of hydrogen from the high pressure gas tank in order to start up a fuel cell.

Kralick teaches water as a heat exchange medium between a fuel cell and a heat exchanger (col. 5, lines 30-31) and that if the reactant gas entering the inlet is warmer than the fuel cell stack, condensation might occur as the saturated gas is cooled to the stack temperature (col. 5, lines 45-65).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use water as the solvent for exchanging heat between the fuel cell and the metal hydride tank 10 because water is commonly used in the art as a heat exchange medium in a coolant circuit because water is non-corrosive, has high heat capacity, is non-toxic, and is easily replenished by the product water of the fuel cell.

It would have also been obvious to one of ordinary skill in the art at the time the invention was made to warm up the fuel cell to a given temperature without power generation or to warm up the fuel cell to a given temperature with power generation because the optimum condition of power generation depends on the relative temperature of the humidified reactant and the temperature of the fuel cell because if a humidified reactant gas entering the fuel cell has a higher temperature that the fuel cell temperature, condensation might occur and cause flooding of the fuel cell membrane that would be detrimental to power generation.

Aldhart et al. teach a fuel cell system with heat exchange between the coolant 74 and the metal hydride alloy tank which comprises two concentric containers 70 and 72 and the container 72 contains the metal hydride bed with container 70 surrounding container 72 and connected to the coolant system of the fuel cell stack (see Figure 6).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the metal hydride alloy tank of Aldhart et al. in the fuel cell system of JP 60-68 A because the heat exchange unit 72 of the metal hydride alloy tank located outside of and surrounding the metal hydride bed provides more space for hydrogen storage and more surface area for heat exchange with the metal hydride bed.

13. Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO00/58529 (equivalent document to Okada et al. (US 6,835,490 B1) relied upon for translation) in view of applicant's English Translation for JP 60-68 A submitted on 4/29/2004, Kralick (US 6,350,535 B1) and Aldhart et al. (US Patent No. 4,826,741) as applied to claim 15 above, and further in view of Pratt et al. (US 6,406,808 B1).

Okada et al. as modified by applicant's English Translation for JP 60-68 A submitted on 4/29/2004, Kralick and Aldhart et al. disclose all the limitations of claims 16 and 17 (see above) except that the hydrogen supplied to the fuel cell depends upon a target pressure of the anode of the fuel cell and that the hydrogen supplied to the fuel cell depends upon a target power generation for the fuel cell.

Pratt et al. teach that the amount of hydrogen released from the metal hydride container has to be controlled such that it matches the target power output, pressure, and concentration of hydrogen in the fuel cell system (col. 1, lines 60-65).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to supply the amount the hydrogen depending upon a target pressure of the anode (fuel) in order to reach a target power output to satisfy a load demand for a given application.

It would have also been obvious to one of ordinary skill in the art at the time the invention was made to supply the amount of hydrogen depending upon a target power generation in order to meet load demands for a given application.

14. Claims 2, 3, 5, and 11 rejected under 35 U.S.C. 103(a) as being unpatentable over WO00/58529 (equivalent document to Okada et al. (US 6,835,490 B1) relied upon for translation) in view of applicant's English Translation for JP 60-68 A submitted on 4/29/2004, as applied to claims 1, 4 and 9 above, and further in view of Kralick (US 6,350,535 B1).

Okada et al. as modified by applicant's English Translation for JP 60-68 A submitted on 4/29/2004 disclose all the limitations of claims 2, 3, 5, and 11 (see above) except that the solvent for exchanging heat between the alloy tank and the fuel cell is water, and that the fuel cell generates power while warming up the fuel cell when the temperature of the fuel cell is within a given temperature range whose upper limit is the prescribed temperature and the warming up is performed with no power generation when the temperature of the fuel cell is under the lower limit of the given temperature range, and that the heat exchanger is located outside of a tank containing the hydrogen-occlusion alloy.

Kralick teaches water as a heat exchange medium between a fuel cell and a heat exchanger (col. 5, lines 30-31) and that if the reactant gas entering the inlet is warmer than the fuel cell stack, condensation might occur as the saturated gas is cooled to the stack temperature (col. 5, lines 45-65).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use water as the solvent for exchanging heat between the fuel cell and the metal hydride tank 10 because water is commonly used in the art as a heat exchange medium in a coolant circuit because water is non-corrosive, has high heat capacity, is non-toxic, and is easily replenished by the product water of the fuel cell.

It would have also been obvious to one of ordinary skill in the art at the time the invention was made to warm up the fuel cell to a given temperature without power generation or to warm up the fuel cell to a given temperature with power generation because the optimum condition of power generation depends on the relative temperature of the humidified reactant and the temperature of the fuel cell because if a humidified reactant gas entering the fuel cell has a higher temperature that the fuel cell temperature, condensation might occur and cause flooding of the fuel cell membrane that would be detrimental to power generation.

15. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO00/58529 (equivalent document to Okada et al. (US 6,835,490 B1) relied upon for translation) in view of applicant's English Translation for JP 60-68 A submitted on 4/29/2004, as applied to claim 4 above, and further in view of Pratt et al. (US 6,406,808 B1).

Okada et al. as modified by applicant's English Translation for JP 60-68 A submitted on 4/29/2004 disclose all the limitations of claims 6 and 7 (see above) except that the hydrogen supplied to the fuel cell from the hydrogen storage alloy tank depends upon gas pressure of the anode of the fuel cell or the hydrogen consumption amount consumed by the fuel cell.

Pratt et al. teach that the amount of hydrogen released from the metal hydride container has to be controlled such that it matches the target power output, pressure, and concentration of hydrogen in the fuel cell system (col. 1, lines 60-65).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to supply the amount the hydrogen depending upon the anode (fuel) pressure in order to reach a target power output to satisfy a load demand for a given application.

It would have also been obvious to one of ordinary skill in the art at the time the invention was made to supply the amount of hydrogen depending on the hydrogen consumption amount consumed by the fuel cell in order to meet load demands for a given application.

16. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over WO00/58529 (equivalent document to Okada et al. (US 6,835,490 B1) relied upon for translation) in view of applicant's English Translation for JP 60-68 A submitted on 4/29/2004 and Monette et al. (US Patent No. 6,240,971 B1).

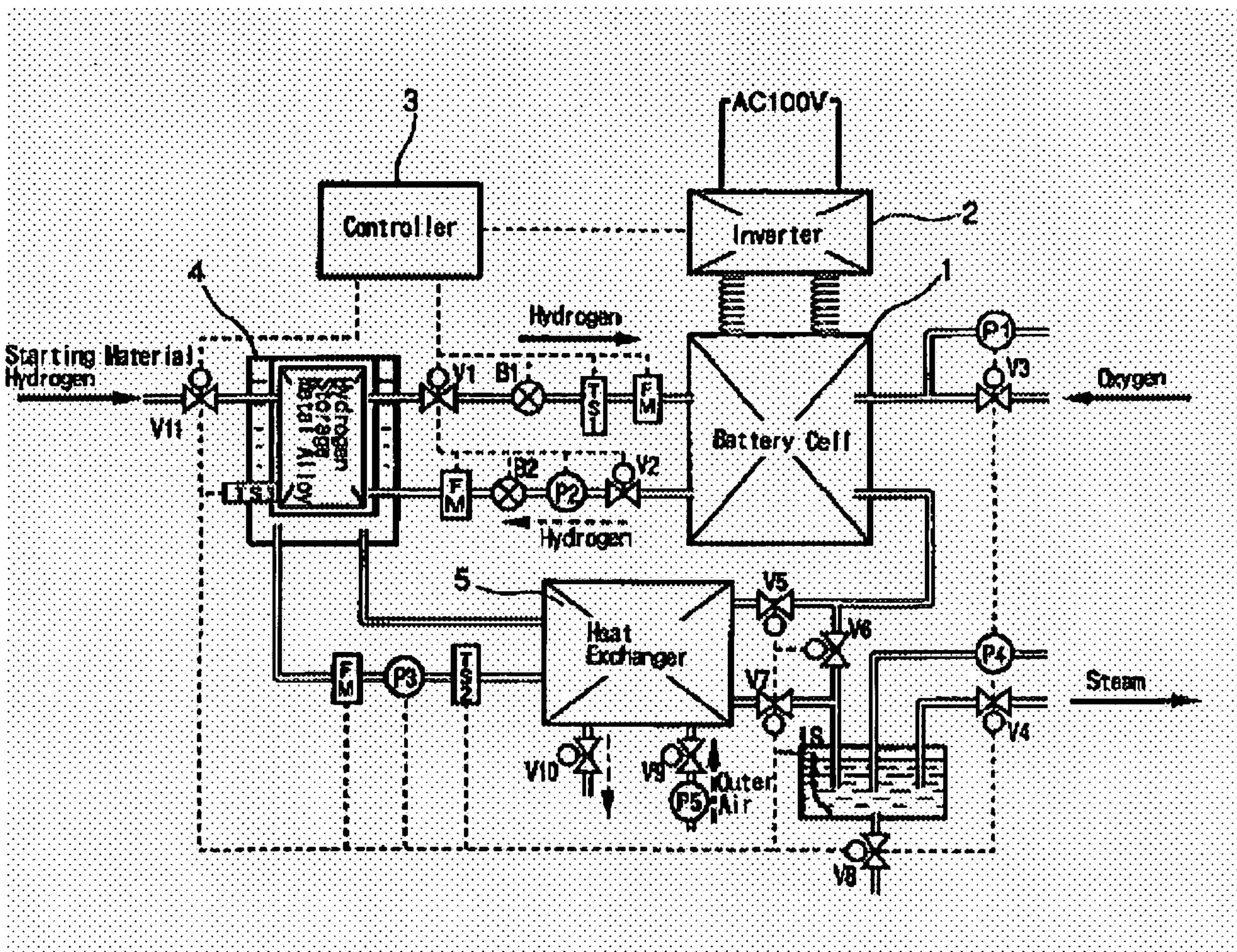
Okada et al. disclose a fuel cell apparatus (see Figure 21 reproduced below) comprising a fuel cell 1, a hydrogen metal hydride storage tank 4 that is capable of supplying the hydrogen occluded in the hydrogen storage metal alloy to the fuel cell, and a heat exchanger 5 that is carried out between the outer air as well as the discharged heat existing in a steam of relatively high temperature discharged from the fuel cell and the cold/warm water as a cooling medium circulated in a cooling/warming medium jacket installed at the <u>outer circumference</u> of the hydrogen metal hydride storage tank 4 (col. 17, lines 12-46). The controller 3 conducts various controls for elevating or lowering the temperature of the hydrogen storage metal alloy in the tank 4, mass control for pressure, flow rate, temperature, etc. with regard to the hydrogen supplied to the fuel cell (col. 17, lines 46-52).

The controller is capable of appropriately controlling a pressure, temperature, and flow rate of the hydrogen gas supplied from the hydrogen metal hydride storage tank to the fuel cell and the pressure, temperature and flow rate of hydrogen gas can be controlled whereby it is possible to control amounts of generated electric energy in the fuel cell depending appropriately

upon the load and to enhance the utilizing efficiency of the hydrogen used in the fuel cell (col. 8, lines 22-33 and col. 18, lines 23-38).

The hydrogen which is to be absorbed with the hydrogen storage metal alloy is supplied as a starting material hydrogen into the tank 4 by connecting a high-pressure hydrogen cylinder to a hydrogen supplying outlet followed by opening the valve V1 whereupon the hydrogen storage metal alloy absorbs the hydrogen from the low-pressure plateau region to the high-pressure plateau region (col. 17, line 65 to col. 18, line 7 and col. 19, lines 8-32).

Simultaneously, the controller releases valves V9 and V10 and also makes pump P5 in an operating state whereby the outer air is sent to the heat exchanger to cool the above-mentioned cold/warm water with the outer air and at the same time, the hydrogen storage metal alloy is monitored with a temperature sensor and the circulation pump P3 is appropriately operated so as to bring the temperature (T1) of the hydrogen storage metal alloy to 40 degree Celsius or lower whereby the above heat-exchanged cold/warm water is appropriately passed into the above-mentioned cooling/warming medium jacket to carry out the cooling of the hydrogen storage metal alloy (col. 18, lines 7-23).



Okada et al. do not disclose heat-transmitting means which transmits heat generated in the hydrogen-occlusion alloy during the course of storing the hydrogen gas from the high pressure hydrogen gas tank in order to warm up the fuel cell and that the high pressure tank is formed of a fiber reinforced plastic for storing hydrogen gas.

The JP 60-68 A reference discloses a fuel cell apparatus comprising a fuel cell 15, a metal hydride 13 having a high hydrogen equilibrium dissociation pressure placed in tank 4 and a metal hydride 14 having a low hydrogen equilibrium dissociation pressure in tank 10 and the two tanks are coupled to each other through hydrogen transfer valves 11 and 12 (see also Figure

2). A heat exchanger 18 is contained in tank 10 and is coupled with a heat exchanger 16 which heats and cools the fuel cell 15 (see page 5 of applicant's translation). Page 5 of the translation also states that a "solvent for exchanging heat is transferred by means of a pump to circulate solvent so that heat can be smoothly transferred." Page 6 of the translation states "the heat is generated in the metallic hydride MH1 when hydrogen is occluded in the metallic hydride MH1. This heat can also be utilized to increase the temperature of the fuel cell so that the fuel cell can be started again at the time when the fuel cell is stopped."

It would have been obvious to one of ordinary skill in the art at the time the invention was made have a heat exchange arrangement between the hydrogen storage alloy tank and fuel cell of Okada et al. in the form of a heat exchanger on the hydrogen storage alloy tank coupled with a heat exchanger which heats and cools the fuel cell by means of a pump to circulate a solvent so that heat can be smoothly transferred to the fuel cell as taught by JP 60-68 in order to efficiently utilize the waste heat released from the hydrogen storage alloy during occluding of hydrogen from the high pressure gas tank in order to start up a fuel cell.

Monette et al. teach that fiber reinforced plastic (FRP) composites are used for pressure vessels or above ground storage tanks since they are superior in corrosion resistance compared to carbon steel, have improved fatigue resistance, and are considerably lighter weight for a given wall thickness than their steel counterparts (col. 1, lines 10-26).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a high pressure tank formed of fiber reinforce plastic for storing hydrogen gas because fiber reinforced composites are superior in corrosion resistance compared to carbon

steel, have improved fatigue resistance, and are considerably lighter weight for a given wall thickness than their steel counterparts (col. 1, lines 10-26).

17. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over WO00/58529 (equivalent document to Okada et al. (US 6,835,490 B1) relied upon for translation) in view of applicant's English Translation for JP 60-68 A submitted on 4/29/2004, Monette et al. (US Patent No. 6,240,971 B1), and Derwent abstract for JP 90061401 B.

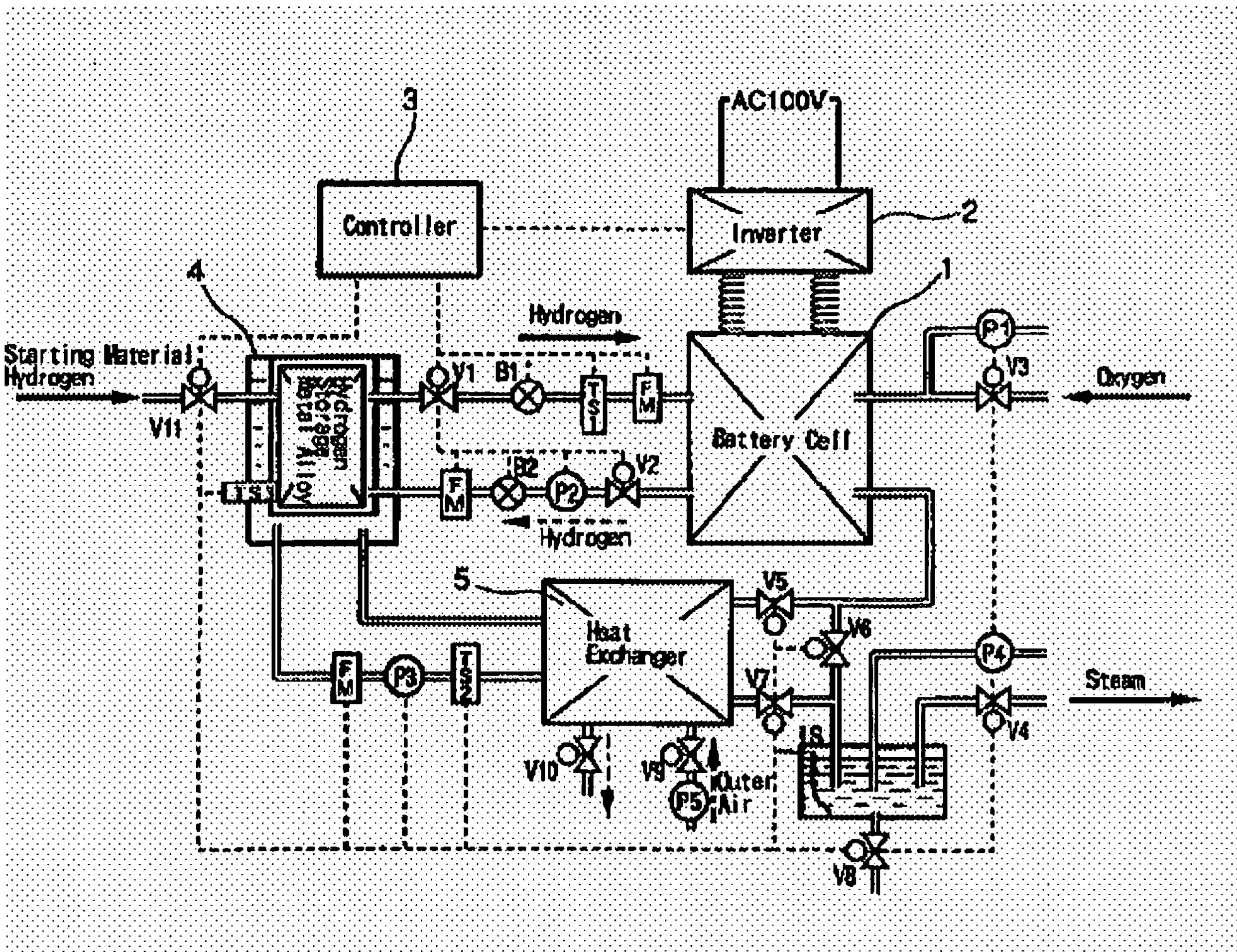
Okada et al. disclose a fuel cell apparatus (see Figure 21 reproduced below) comprising a fuel cell 1, a hydrogen metal hydride storage tank 4 that is capable of supplying the hydrogen occluded in the hydrogen storage metal alloy to the fuel cell, and a heat exchanger 5 that is carried out between the outer air as well as the discharged heat existing in a steam of relatively high temperature discharged from the fuel cell and the cold/warm water as a cooling medium circulated in a cooling/warming medium jacket installed at the outer circumference of the hydrogen metal hydride storage tank 4 (col. 17, lines 12-46). The controller 3 conducts various controls for elevating or lowering the temperature of the hydrogen storage metal alloy in the tank 4, mass control for pressure, flow rate, temperature, etc. with regard to the hydrogen supplied to the fuel cell (col. 17, lines 46-52).

The controller is capable of appropriately controlling a pressure, temperature, and flow rate of the hydrogen gas supplied from the hydrogen metal hydride storage tank to the fuel cell and the pressure, temperature and flow rate of hydrogen gas can be controlled whereby it is possible to control amounts of generated electric energy in the fuel cell depending appropriately

upon the load and to enhance the utilizing efficiency of the hydrogen used in the fuel cell (col. 8, lines 22-33 and col. 18, lines 23-38).

The hydrogen which is to be absorbed with the hydrogen storage metal alloy is supplied as a starting material hydrogen into the tank 4 by connecting a high-pressure hydrogen cylinder to a hydrogen supplying outlet followed by opening the valve V1 whereupon the hydrogen storage metal alloy absorbs the hydrogen from the low-pressure plateau region to the high-pressure plateau region (col. 17, line 65 to col. 18, line 7 and col. 19, lines 8-32).

Simultaneously, the controller releases valves V9 and V10 and also makes pump P5 in an operating state whereby the outer air is sent to the heat exchanger to cool the above-mentioned cold/warm water with the outer air and at the same time, the hydrogen storage metal alloy is monitored with a temperature sensor and the circulation pump P3 is appropriately operated so as to bring the temperature (T1) of the hydrogen storage metal alloy to 40 degree Celsius or lower whereby the above heat-exchanged cold/warm water is appropriately passed into the above-mentioned cooling/warming medium jacket to carry out the cooling of the hydrogen storage metal alloy (col. 18, lines 7-23).



Okada et al. do not disclose heat-transmitting means which transmits heat generated in the hydrogen-occlusion alloy during the course of storing the hydrogen gas from the high pressure hydrogen gas tank in order to warm up the fuel cell, that the high pressure tank is formed of a fiber reinforced plastic for storing hydrogen gas, and that the hydrogen storage alloy tank is made of an aluminum alloy such that the aluminum alloy of the hydrogen storage alloy tank would have a higher heat conductivity than the high pressure tank made of fiber reinforced plastic.

The JP 60-68 A reference discloses a fuel cell apparatus comprising a fuel cell 15, a metal hydride 13 having a high hydrogen equilibrium dissociation pressure placed in tank 4 and a metal hydride 14 having a low hydrogen equilibrium dissociation pressure in tank 10 and the two tanks are coupled to each other through hydrogen transfer valves 11 and 12 (see also Figure 2). A heat exchanger 18 is contained in tank 10 and is coupled with a heat exchanger 16 which heats and cools the fuel cell 15 (see page 5 of applicant's translation). Page 5 of the translation also states that a "solvent for exchanging heat is transferred by means of a pump to circulate solvent so that heat can be smoothly transferred." Page 6 of the translation states "the heat is generated in the metallic hydride MH1 when hydrogen is occluded in the metallic hydride MH1. This heat can also be utilized to increase the temperature of the fuel cell so that the fuel cell can be started again at the time when the fuel cell is stopped."

It would have been obvious to one of ordinary skill in the art at the time the invention was made have a heat exchange arrangement between the hydrogen storage alloy tank and fuel cell of Okada et al. in the form of a heat exchanger on the hydrogen storage alloy tank coupled with a heat exchanger which heats and cools the fuel cell by means of a pump to circulate a solvent so that heat can be smoothly transferred to the fuel cell as taught by JP 60-68 in order to efficiently utilize the waste heat released from the hydrogen storage alloy during occluding of hydrogen from the high pressure gas tank in order to start up a fuel cell.

Monette et al. teach that fiber reinforced plastic (FRP) composites are used for pressure vessels or above ground storage tanks since they are superior in corrosion resistance compared to carbon steel, have improved fatigue resistance, and are considerably lighter weight for a given wall thickness than their steel counterparts (col. 1, lines 10-26).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use high pressure tank formed of fiber reinforce plastic for storing hydrogen gas because fiber reinforced composites are superior in corrosion resistance compared to carbon steel, have improved fatigue resistance, and are considerably lighter weight for a given wall thickness than their steel counterparts (col. 1, lines 10-26).

The Derwent abstract for JP 90061401 B disclose that a hydrogen storage alloy vessel made of hard aluminum alloy used in providing heat-sources for machines.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a hydrogen-occlusion alloy tank formed of aluminum alloy because it has good thermal conductivity to transfer heat from the hydrogen-occlusion alloy tank when the tank is used as a heat source.

Allowable Subject Matter

18. Claims 20 and 21 are allowed.

19. The following is a statement of reasons for the indication of allowable subject matter: The closest prior art of record, Okada et al. do not disclose, teach, or suggest either of the following distinguishing features: (1) a branched pipe connecting the high-pressure tank to the hydrogen-occlusion alloy tank and the fuel cell, the branched pipe including a first branch for transferring hydrogen discharged from the high-pressure tank to the hydrogen-occlusion alloy in the hydrogen-occlusion alloy tank and a second branch for transferring hydrogen discharged from the high-pressure tank to the fuel cell (applies to claim 20) or (2) a three-way valve for switching between a stationary position, in which hydrogen discharged from the high-pressure

tank is directed towards the fuel cell, and a warming-up position, in which hydrogen discharged from the high-pressure tank is directed towards the hydrogen-occlusion alloy tank (applies to claim 21).

Conclusion

Any inquiry concerning this communication or earlier communications should be directed to examiner Susy Tsang-Foster whose telephone number is (571) 272-1293. The examiner can normally be reached on Monday through Friday from 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached at (571) 272-1292.

The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

st/ Susy Tsang-Foster

SUSY TSANG-FOSTER
PRIMARY EXAMINER